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Financing Higher Education: Public Choice and Social Welfare

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I. INTRODUCTION

This paper considers the use of fees versus the use of taxation for the finance of higher education in a framework that pays special attention to some of the interdependencies involved. In particular, the use of subsidies, in the form of a higher education grant to students, involves, via the government's budget constraint, an increase in taxation. This increase in income taxation imposes an obvious burden on those who do not invest in higher education, but it is not a 'free' good from the point of view of the grant recipients who must pay higher taxes than otherwise during their working lives. This component of taxation may be called a *deferred fee*.

If there is a substantial external effect resulting from the higher education of a minority of the population, the appropriate policy response depends on the relevant *marginal* benefits and costs. It is thus important to consider the distribution of those marginal costs and benefits and the decision-taking mechanism of the government. The following discussion uses both a public choice framework, involving majority voting over the level of a grant, and a welfare economics approach which involves the maximisation of a social welfare function. In view of the fact that some people are likely to be made worse off

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while others are better off, the analysis cannot be restricted to Pareto improvements and explicit distributional judgements have to be made.

In focusing on these issues, it is necessary to construct a model. Such a model has been constructed and examined in a series of papers by Creedy and Francois (1990, 1992a, 1992b, 1993b and 1994). This involved a certain amount of technical analysis, so the purpose of this paper is to describe the main features of the analysis in a non-technical manner. It inevitably ignores many aspects of the finance of higher education which are important, in order to focus on a narrower range of issues which seem to have been given relatively less attention in the literature. Indeed, in reviewing a large collection of papers on the economics of education, Blaug (1989, p. 334) complained that 'the application of standard welfare economics applied to education is never given its proper due'. Section II briefly discusses some of the standard arguments for subsidising higher education and outlines the interdependencies examined later. The framework of analysis is presented in Section III, involving individuals' investment decisions, the government's budget constraint and an equilibrium in which all plans are mutually consistent. Section IV examines the majority voting equilibrium of the model and considers its comparative static properties. The use of a social welfare function defined in terms of the net lifetime incomes of individuals is considered in Section V. Finally, Section VI provides brief conclusions.

II. SUBSIDIES FOR HIGHER EDUCATION

In most industrialised countries, there are substantial public subsidies, financed by general taxation, for higher education. These subsidies exist despite the fact that higher education does not have the characteristics of standard 'public goods'. In particular, its provision is subject to excludability and rivalry. Nevertheless, several other rationales are usually given for tax-financed subsidies. First, higher education is subject to market failure because it is an investment good involving a long time horizon and uncertain returns, and capital markets are imperfect. The high costs, involving forgone earnings as well as direct costs in the form of fees, are consequently often met by intra-family (intergenerational) transfers. This may perpetuate wealth inequalities and reduce social mobility; see Hare and Ulph (1982).

A second reason given for the view that higher education will not be consumed at the socially optimal level without some form of subsidy is that it is a 'merit good'. This kind of argument provides part of the rationale for primary and secondary education being compulsory in many countries, but it is less convincing in the case of higher education. The merit good case is fairly controversial; for example, Becker (1974) has argued that its application can in some circumstances reduce the consumption of higher education, and his argument is criticised by Arcelus and Levine (1986).

Third, a widely cited reason for tax-financed support is that higher education generates externalities. It yields a flow of returns over the working life to the investing individuals, but there are additional benefits which cannot be appropriated by those individuals. This argument is also controversial. Blaug (1989, p. 332) argued that 'we cannot specify, much less measure, the externalities generated by educated individuals'. He was also critical of the tendency of many authors to list the various types of external benefit and then infer with confidence that there is a strong case for substantial state subsidies; see also Hope and Miller (1988). The debate is sometimes confused by a desire to regard the additional tax revenue, arising from the higher earnings generated by higher education, as a form of external effect. It seems best, however, to make a clear distinction between a change in the tax base and other effects. In the present paper, emphasis is placed on an externality which arises from interdependencies in the production process between skilled and unskilled individuals. The existence of a larger proportion of skilled workers raises the productivity of *all* workers. This argument has been modelled formally by Johnson (1984).

The argument in favour of subsidies as a way to increase equality cannot really be applied in this context, given a strong correlation between income-earning ability and the ability to benefit from higher education. As suggested by Hope and Miller (1988, p. 42) in the Australian context, 'The abolition of tuition charges in 1974, which provided an across-the-board subsidy to all students at the tax payer's expense, may thus be viewed as a redistribution from the poor(er) to the rich(er)'. The question to be asked is therefore the same as that raised by Johnson (1984, p. 305), who asked 'why, then, should the entire population be required to subsidise an activity that provides direct benefits only to the wealthiest segment?'. A somewhat different approach is that of Lommerud (1991) who uses a model in which individuals' utility depends on their relative position in the income distribution and suggests that 'it might be optimal to tax away some of the differences in people's labour income — and to use educational subsidies to restore people's incentives to undertake education' (Lommerud, 1991, p. 651).

The perspective generally taken is that government subsidies are a form of investment in human capital, but with a negative rate of return when viewed in terms of the fiscal return to the government. The various arguments mentioned above are thus used to suggest that even with such a negative rate of return, investment is warranted. Holcombe and Holcombe (1984, p. 368) have argued, in the context of the US, that investment 'makes sense even within the narrow framework of a wealth maximising government', but it seems unlikely that this kind of argument would find wide support.

The above arguments are not sufficient to argue either that governments *will* or *should* provide tax-financed subsidies. It is necessary to consider explicitly the decision-taking mechanisms and the social evaluation rules adopted, along

with the costs of government intervention. For example, the subsidies must be financed from higher taxes (or borrowing, which involves higher future taxes) which may involve distortions that outweigh the benefits of the subsidies. Faced with a vast range of types of subsidy, this paper focuses on a small number of aspects of higher education finance involving the use of student grants to subsidise tuition costs. The advantage of the model is that it attempts to allow both for the general equilibrium implications of the government's budget constraint and for the endogeneity of the government's decision. The paper also focuses on external productivity effects. This is not to deny the potential importance of the other considerations; rather, it reflects the difficulty of handling all the issues simultaneously. Hence, in what follows, capital market imperfections are ignored and individuals are assumed to be able to borrow as much as required at the fixed market rate of interest which is the same as that at which the government can borrow. The policy implications are, of course, quite different. For example, if imperfections in capital markets are regarded as the major issue, then student loans rather than direct grants (or tuition subsidies) are suggested. A zero real rate of interest applied to the loan provides a subsidy to all those who borrow, and simultaneously gives a slight advantage to those who repay more slowly, that is, those with flatter and lower earnings profiles. It would then be necessary to consider the range of problems associated with income-contingent loans, though these are also likely to require tax-financed subsidies.

The simplest type of subsidy is an unconditional grant to all individuals who invest in higher education, financed by an increase in the personal income tax. A feature of such grants is that they are not free; they involve higher taxes over the working lives of recipients of the grants as well as those who do not invest. This gives rise to the concept of a *deferred fee*, which takes the form of a higher stream of tax payments than otherwise on those who receive the grant. Unconditional grants, even when combined with a progressive income tax schedule, will increase lifetime inequality. Nevertheless, low-income individuals who do not invest, and who form a substantial majority of the population, may vote for a grant where the benefits to them, arising from the external effects of higher education, exceed the costs. The costs arise from the higher taxes, mitigated to some extent by the higher tax base generated.

1. Government and Individual Decisions

The following approach assumes that individuals, in making their educational choice decision, attempt to maximise net lifetime income subject to constraints. The relevant constraints include their 'ability' and the tax structure imposed by the government. The government is subject to a budget constraint such that the tax system must generate the required revenue to finance higher education

expenditure, given individuals' responses to the tax and subsidy system. Hence, the framework must explicitly allow for these interdependencies.

The government is not satisfied merely to ensure that its budget constraint is met. The first approach considered below assumes that the government carries out that policy which is preferred by a majority of individuals. The second approach is one in which a conventional social welfare function, defined in terms of individuals' net lifetime incomes, is maximised. An extensive argument for a public choice approach has been made by Majumdar (1983), and some empirical support found by Lovell (1978). Many aspects of public choice in education are examined in Bowman (1986).

In each case, of the public choice and social welfare approaches, the income tax system is taken as given, though the tax rates are endogenously determined. Hence, the government is faced with a decision problem involving only one dimension. It is well known that public choices involving several variables are very complicated, though it might be argued that a more satisfactory approach would produce a model that is capable of examining the complete tax and transfer system simultaneously. While this point must be accepted at a general level, it imposes a severe requirement and this approach is therefore very seldom followed.

A further reason for separating the analysis along such lines was suggested by Hare (1988), who argued (p. 76) that

> governments typically *do not* co-ordinate their spending and tax policies in the careful way that economic theory suggests they should. So it makes sense to think about, say, education policy in the presence of a given tax regime; and conversely we could analyse tax schedules given an education policy. Taken to its logical conclusion the combination of these partial optimisations would presumably yield some form of Nash equilibrium.

2. Some Interdependencies

Within a public choice approach, the major question to be considered is as follows: under what circumstances would a majority of individuals be prepared to vote for a proportion of the cost of higher education per person to be met from tax revenue, given that the majority will not find it worthwhile to invest in education? The following analysis is restricted to a single cohort of individuals. This is not meant to deny that intergenerational issues are relevant, but they do introduce additional highly complex problems. The discussion is offered as the first stage in a more complete analysis. Each individual may be supposed to have an exogenously determined endowment of ability both to obtain income if uneducated and to benefit from further education. It is not necessary, for present purposes, to specify precisely what constitutes income-earning ability; it may be regarded as some combination of many separate factors, including family background. Those with a higher endowment are assumed to obtain a relatively

higher income even if they are not educated, and obtain a relatively higher increase in earnings if they become educated.

The educational choice decision is based on an assessment by each individual of the net present value of lifetime earnings. Important factors in this calculation are the direct private cost of education and the nature of the tax system, in addition to the perceived earnings that result from higher education. The cost of education includes both earnings forgone while individuals delay entry into the labour market and any fee which must be paid. Education will be less desirable to the extent that the tax system is more progressive and average tax rates are higher. The endowment level below which it is not worthwhile investing in higher education may be called the *educational choice margin*. An individual at the margin will expect the same net lifetime earnings whether educated or not. Assume for the time being that higher education is not subject to rationing, so that the supply is demand-determined; the introduction of rationing is discussed in Section IV. The model does not allow for labour supplies to be affected by the income tax system, other than the effect of income taxes on the incentive to invest in higher education. The complications involved in introducing learning into a multi-period optimal tax model are illustrated by Brunner (1986).

The Introduction of a Grant

In considering the various interdependencies, it is useful to begin from a situation in which all higher education costs are met from fees imposed on those who invest in it. Suppose that a policy is then introduced whereby each educated individual has to pay only a specified proportion of the full fee, while the remainder of the cost is met through the income tax system. Each individual receives an unconditional government grant to pay a proportion of the required fee.

The first effect of the introduction of the grant is that the educational choice margin will fall, since those who were just below the old margin find it worthwhile to invest in higher education. This means that tax rates must be adjusted if deficit neutrality is to be maintained. To the extent that the tax system is progressive, the burden of the additional tax will fall relatively more on those with higher earnings, who are largely those who receive the private returns from education. Even with a proportional tax system, the educated will pay more in taxation than they would pay when there is no grant. This increase in taxation will modify to some extent the ‘initial’ or ‘first-round’ effect of the grant in reducing the educational choice margin. A further possibility resulting from the reduction in the educational choice margin is that, because of the increase in the supply of more highly skilled workers and the reduction in the supply of less-skilled workers, the relative wages of those who invest in higher education will fall. In this case, those who receive the grant, but would otherwise invest in higher education anyway, are forced to bear a further cost.

Majority Support for a Grant

The majority of individuals are expected to be below the educational choice margin. Given that investment in education leads to higher earnings over the working life, the introduction of a grant increases the tax base, and this mitigates against any rise in taxes caused by the need to finance the grants through the tax system. This does not explain why the non-educated majority would vote in favour of a grant system. However, the existence of external effects may mean that the marginal benefit may exceed the marginal cost of an increase in the grant for those who do not invest. Suppose, as mentioned above, that the increase in the number of people with higher education results in a general increase in productivity such that *all* individuals benefit from an increase in earnings. There may also be non-pecuniary external effects, but these are ignored here.

The literature on external effects is not clear about the precise nature of such benefits. Suppose, however, that the general rate of increase in earnings is higher the higher is the proportion of the population educated, although decreasing returns may be expected. If this effect is combined with that of the higher tax base resulting from private returns, there is a possibility that an increase in the grant can ultimately raise the net lifetime income of the uneducated, even if they also pay more tax. However, the existence of a positive externality arising from higher education is not sufficient to generate majority support for the use of tax-financed grants; the general growth rate of earnings experienced by everyone as a result of productivity gains must outweigh the effects of the higher taxation. This kind of general discussion cannot establish the precise level of the grant; further analysis requires the use of a model.

The assumption that the general increase in productivity is related to the proportion of individuals investing in higher education has implications for the use of merit-based grants or scholarships. From the point of view of those below the educational choice margin, concern is with the *marginal* benefits and costs of an increase in the tax-financed grant. The use of a grant which is available only to those with very high ability, and who would anyway invest in higher education, would have very little to recommend it. The grant should, where possible, be concentrated on those close to the margin unless, of course, a very different view about the source of external effects is taken. A similar point has been made by Baum and Schwartz (1988).

III. A SIMPLE FRAMEWORK OF ANALYSIS

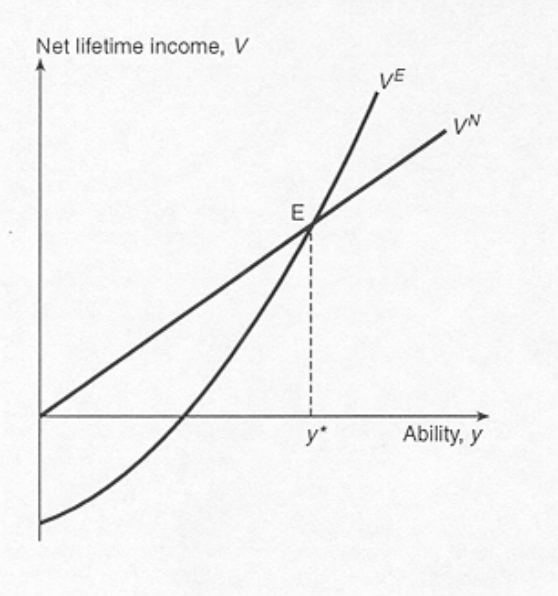
1. The Investment Decision

In order to simplify the analysis, higher education is regarded purely as an investment good and the model will abstract from differences between academic subjects. These assumptions are obviously unrealistic but are unlikely to

influence the major results. Investment requires fees and a period of full-time study involving forgone earnings. This contrasts with the model of Johnson (1984) who assumes that higher education is undertaken instantaneously. The additional simplification is made that all individuals who invest in higher education will automatically graduate; a degree is regarded simply as providing an attendance certificate. This does not mean that all individuals benefit equally from the investment, since there is a distribution of ability. The practical question of whether higher education imparts useful cognitive skills or is simply a rather expensive form of screening device is thus bypassed by the assumption that it is indeed an investment in the acquisition of productive skills.

FIGURE 1

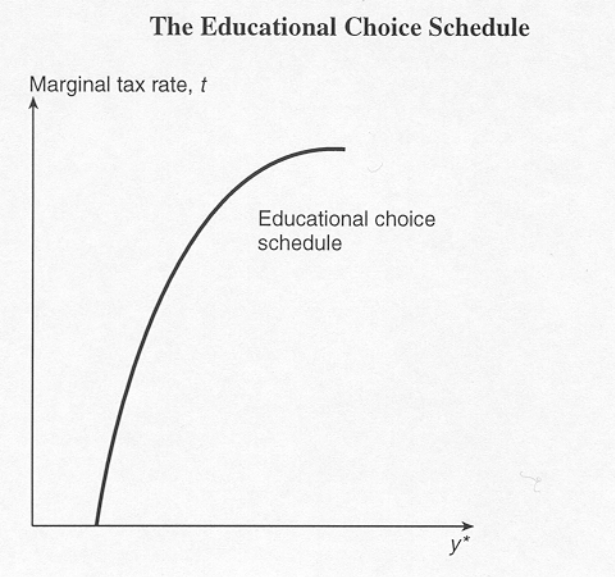
The Educational Choice Margin



The investment decision can usefully be considered using a diagram in which net lifetime income, *V*, is measured on the vertical axis and ability, *y*, is measured on the horizontal axis, as in Figure 1. Consider a single cohort of individuals. For those who do not invest in higher education, the relationship between net lifetime income and ability is shown by the profile marked V^N. This starts at the origin, and is a straight line if there is a proportional tax system. The profile for those who invest is shown as V^E. This starts from below the origin, because the costs (despite the low forgone earnings) outweigh the gains for such low-ability individuals. Beyond some point, the gains outweigh the costs and V^E

becomes positive. If the benefit from higher education (in terms of the extent to which earnings during the working life are higher than they would otherwise be) is positively related to ability, *y*, then the profile V^E will be convex. This convexity is not likely to be outweighed by any tax progressivity. There is

FIGURE 2



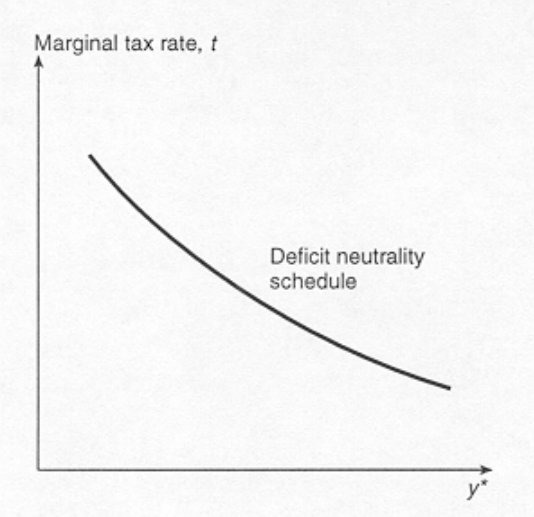
therefore a single point, E, at which the two lines cross, corresponding to an ability level of y^*. This level is the *educational choice margin.* All those with ability in excess of this level will find it worthwhile to invest in higher education. The above explanation has been somewhat over-simplified because it has ignored two effects. First, there is a *tax base effect* since the earnings of those who invest are higher than otherwise, and secondly, there is a *productivity effect* arising from the complementarity between skill levels. Both these effects depend on the educational choice margin, y^*. This means that the profiles shown in Figure 1 must be regarded as being mutually consistent with that value of y^* given by their intersection; the two-dimensional nature of the diagram is not sufficient to capture the full extent of the interdependencies involved.The educational choice margin depends therefore on a variety of factors, but it is useful to consider the partial relationship between y^* and the marginal tax rate, *t*. The relationship is referred to as the *educational choice schedule*. For the time being, it is best to think of a proportional tax system in which all income is taxed at the same fixed rate. The relationship between the educational choice margin and the tax rate may be expected to take the kind of shape illustrated in Figure 2.

As the tax rate approaches unity, it is not worthwhile for anyone to invest in higher education, whatever their ability level, so that this educational choice schedule will asymptotically approach the horizontal line at $t = 1$. The precise shape and position of the choice schedule depends on other factors, such as the nature of the private returns to investment, the extent of the external effect, the size of the grant, and the amount of government revenue which needs to be raised for other purposes.

2. The Government Budget Constraint

FIGURE 3

The Deficit Neutrality Schedule



As with educational choice, consider the partial relationship between the required tax rate and the educational choice margin. As the choice margin falls, government expenditure must increase. This expenditure is financed by raising the tax rate, *t*, so that the relationship is expected to be downward-sloping from left to right, as shown in Figure 3. This relationship is referred to as a *deficit neutrality schedule*. This is because the total revenue raised from the income tax varies along the length of the schedule, but net revenue is held constant.

As mentioned earlier, the extent of the tax change is mitigated to some extent by the increase in the tax base. This in turn depends both on the private returns to investment and on the external productivity effect which benefits even those who do not invest. The schedule is therefore expected to be relatively flat, particularly for relatively high values of y^*. This slope is to some extent also

related to the form of the distribution of ability, y. If this distribution is positively skewed, then reductions in y^* which take place in the right-hand tail of the distribution of y will have a smaller effect on the number of individuals who are induced to invest, thereby causing a smaller increase in the required expenditure.

3. Equilibrium Combinations

The situation whereby the choices of individuals, made subject to a given tax structure, are consistent with the government's satisfaction of its budget constraint is given by the intersection between the educational choice schedule and the deficit neutrality schedule. Given the equilibrium combination of the tax rate, t, and the educational choice margin, y^*, the net lifetime incomes of all individuals are determined. If the margin y^* were transformed, via the distribution of ability, into the proportion of the cohort investing in higher education, then the resulting two schedules may be regarded as types of supply and demand curves, in terms of the 'tax price'. Equilibrium occurs at the intersection of such demand and supply curves.

One implication of this type of equilibrium is worth stressing. At the educational choice margin, the rate of return from investing in higher education is equal to the rate of interest at which all individuals (and the government) lend and borrow. Above the margin, there is a *distribution* of rates of return. In examining the comparative statics of alternative policies, it is important to find what happens to those near the margin, since the investment decisions of those who are well above or below the margin are unlikely to be affected. The implications for those near the margin may not be reflected in changes in the arithmetic mean rate of return or some other measure of location of the complete distribution of rates of return. Despite the existence of the distribution of rates, empirical studies usually attempt to estimate a single value of some rate of return to higher education, based on average earnings profiles. Furthermore, the calculation of a rate of return based on the average earnings profiles of two groups — those observed to be above and those observed to be below the educational choice margin — would be misleading as an indication of private rates of return. The differences between the two average earnings in each period reflect the distribution of ability as well as the effect of higher education. Empirical estimates will thus be biased upwards if they ignore the interaction between ability and education. The problem is that it is not possible to observe directly what individuals would have earned if they had not invested in higher education; see also Blaug (1989).

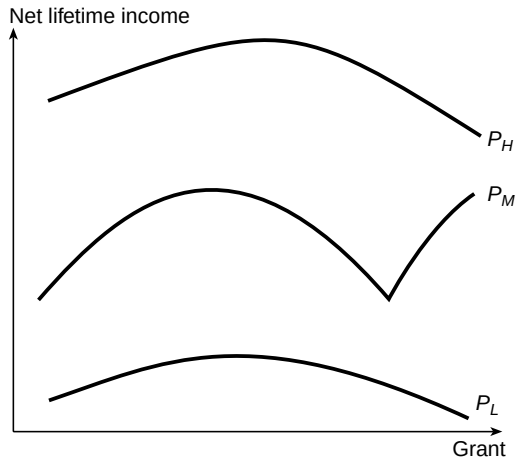
IV. A MAJORITY VOTING EQUILIBRIUM

1. Majority Voting with Proportional Taxation

Any point of intersection between a deficit neutrality schedule and an educational choice schedule reflects consistency between all individuals' plans and the government's budget constraint being satisfied. As the level of the grant is changed, both schedules shift. Consider the variation in the net lifetime income of individuals as the level of the tax-financed grant is gradually increased. Such a relationship defines the preference profile of each individual. Those who have very high ability levels would invest in higher education even if there were no grant. As the grant increases, they will benefit as recipients of this transfer, but their lifetime taxation will also increase. Initially, the extra grant (combined with external effects) may be expected to outweigh the extra tax costs for such individuals, so that their preference profiles will be upward-sloping. Beyond some level of the grant, however, the extra tax cost will outweigh the marginal benefit, leading the preference profiles to turn downwards. Such a profile is shown as P_H in Figure 4.

FIGURE 4

Preference Profiles



Those with medium ability levels may not find it worthwhile to invest when the grant is very low. However, their net lifetime incomes may at first rise as the grant is increased, as a result of the external productivity effects from which they benefit, but again fall as the tax cost outweighs the benefits of further increases. Nevertheless, as the grant is increased further, such individuals may at some

point find it worthwhile to invest in higher education. The implication of this kind of variation is that such individuals have double-peaked preferences for the grant. An example of such a preference profile is shown as P_M in Figure 4, and this is likely to represent a substantial proportion of the cohort. However, those with very low ability levels will never find it worthwhile to invest so that they, like the high-ability people, are expected to have single-peaked preferences, as shown by P_L.

A result of public choice theory is that if all individuals have single-peaked preferences, a stable majority voting equilibrium exists in which the median voter dominates — the median voter being identified as the person whose peak of the preference profiles is in the middle. If, however, preference profiles are not all single-peaked, as in the present context, there is not necessarily a majority voting equilibrium; 'cyclical' voting can result in which social choices appear to be intransitive even though all individuals have consistent preferences. The existence of double-peaked preferences for a higher education grant therefore raises potentially serious problems for the analysis of majority choices. Fortunately it can be shown that a stable equilibrium exists in the special case of proportional taxation.

If the income tax is proportional, all those who are below the educational choice margin agree about the level of the grant that maximises their net lifetime incomes. Their preference profiles have their peak at the same grant level, even if some profiles may turn upwards at very high grant levels. This is because, with a proportional tax, net lifetime income for those below y^*, as shown by V^N in Figure 1, is proportional to ability. Hence in maximising V^N with respect to the grant level, even after allowing for the various interdependencies involved, the level of ability is irrelevant. Given that significantly less than 50 per cent of individuals invest in higher education, there will not be a problem about finding a majority voting equilibrium. The median voter may be identified simply as the individual with median ability level.

Given the non-linear form of the V^E schedule in Figure 1, maximisation with respect to the level of the grant will produce a first-order condition in which the ability level does not cancel. Hence those above the margin are not unanimous in their choice of grant size. This diversity of views among those who invest in higher education contrasts with the model of Johnson, in which 'all members of the bright segment of the population will have the same opinion about what the tuition subsidy rate should be' (Johnson, 1984, p. 306).

The question arises of whether there can be more than one majority voting equilibrium value of the grant, given the highly non-linear nature of the model. Could there be a low grant and low tax equilibrium, along with a high grant and high tax equilibrium? The existence of two equilibria would present awkward analytical problems, especially in considering the comparative static characteristics of the model. For example, a small change in an exogenous variable may lead to a large discrete jump in the majority choice of the grant.

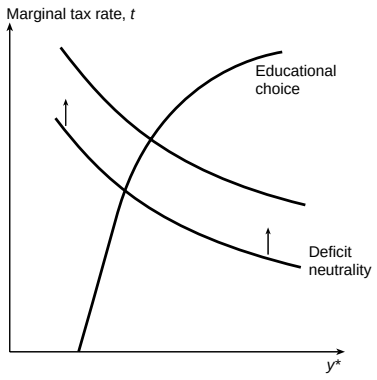
However, such multiple equilibria are ruled out by the requirement that less than 50 per cent of the population invests in higher education. Any attempt to extend the approach, to deal with a context in which those who do not invest can possibly form a minority, must pay serious attention to the possibility of more than one equilibrium position.

2. Some Comparative Statics

In the proportional tax case discussed above, the majority voting equilibrium value of the grant is given by that grant for which the marginal cost of a grant increase just balances the marginal benefit, for any individual not investing in higher education. The marginal cost reflects the extra tax which must be paid, resulting from the extra grant to those already investing, and the additional tax cost resulting from the drop in the educational choice margin. The latter depends on the relative position of the choice margin in the ability distribution, the shape

FIGURE 5

An Increase in Non-Education Expenditure

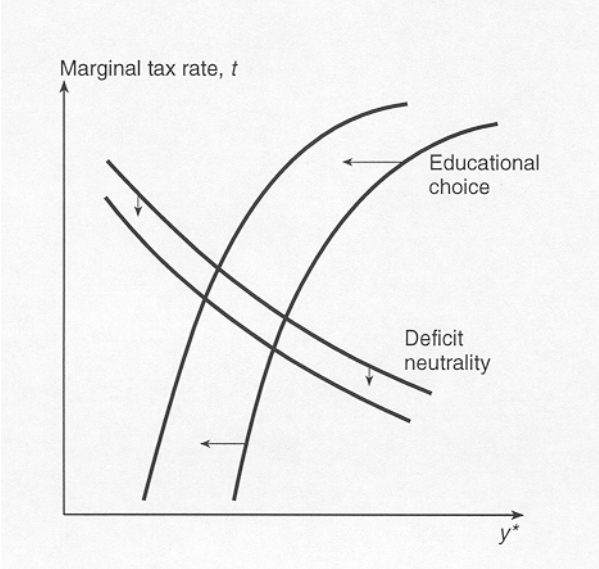


of that distribution and the extent to which the tax base is altered. The marginal benefit depends on the external effect which leads to an increase in productivity and thus an increase in the incomes of everyone. This in turn depends on the relationship between the external effect and the proportion investing in higher

education (which is expected to be concave), and therefore also on the form of the ability distribution at the choice margin. The marginal benefit of increasing the grant will fall as the grant increases (so long as the individual remains below the educational choice margin), while the marginal cost will rise, so that a unique equilibrium is expected. The effects of any exogenous changes may be examined by considering how the change is likely to affect these marginal costs and benefits to those below the educational choice margin.

FIGURE 6

An Increase in Private Benefits



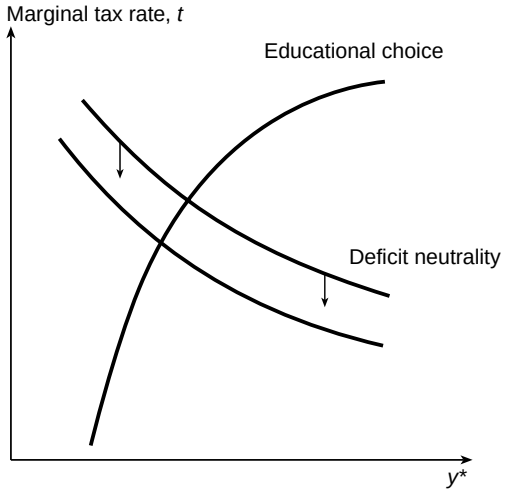
Suppose the net revenue required by the government increases, resulting from an increase in expenditure on non-education-related goods and services. Assume for simplicity that this increase has no indirect effects on the earnings of individuals or the returns from higher education. The effect of the increase in expenditure is thus to leave the educational choice schedule unchanged, but to shift the deficit neutrality schedule vertically upwards, as shown in Figure 5. This leads unambiguously to a rise in the choice margin, y^*, and a rise in the tax rate, t. The rise in the choice margin is associated with a fall in the proportion investing and therefore also with a fall in the external benefit, and consequently a fall in the tax base. Given the assumed concavity in the relationship between the external benefit and the proportion investing in higher education, the marginal benefit of an increase in the grant is increased, with little effect on the marginal cost. Although the absolute value of the tax rate is higher, in order to

finance the extra non-educational expenditure, it is the *marginal* cost of increasing the grant which is relevant here. The net effect is therefore that the exogenous increase in government spending leads to an endogenous increase in the majority choice of the grant, and therefore a further increase in the tax rate. The obvious implication is that if the government is cutting non-education expenditure, for whatever reason, the majority choice also favours cuts in higher education spending through a cut in the grant.

Consider next an increase in the private benefits from higher education, reflecting higher rates of return at all ability levels. The effect on the two schedules is illustrated in Figure 6. The educational choice schedule shifts leftwards, reflecting the greater attraction of higher education, while the deficit neutrality schedule shifts downwards, reflecting the higher tax base associated with any given value of y^*. The net effect on the tax rate is therefore unclear at this stage, although the choice margin is expected to fall. The associated increase in the proportion investing leads to a decrease in the marginal benefit to those below y^* of an increase in the grant. The net result is ambiguous, so further analysis requires the use of a model with much more specification. Creedy and Francois (1990) show that the most likely effect is that the fall in the marginal benefit dominates any change in the marginal cost, implying that higher private returns lead to a fall in the majority choice of grant.

FIGURE 7

An Increase in External Effects



Suppose next that there is an increase in the external benefit resulting from the complementarity between the groups in production. This does not affect the

educational choice schedule where the income tax is proportional, but the deficit neutrality schedule shifts downwards because of the effect on the tax base. Figure 7 shows that the educational choice margin and the tax rate fall, although the former reduction is relatively small given the steepness of the choice schedule over the range shown. If the proportional tax rate, t, is initially high, there will be a larger effect on the margin, y^*. The marginal benefit of raising the grant is reduced, while the marginal cost falls. The final result is again not entirely clear without further structure being imposed on the model. However, Creedy and Francois (1990) show that the likely result is an endogenous increase in the grant preferred by the majority. This means that the reduction in the marginal cost outweighs the reduction in the marginal benefit of raising the grant.

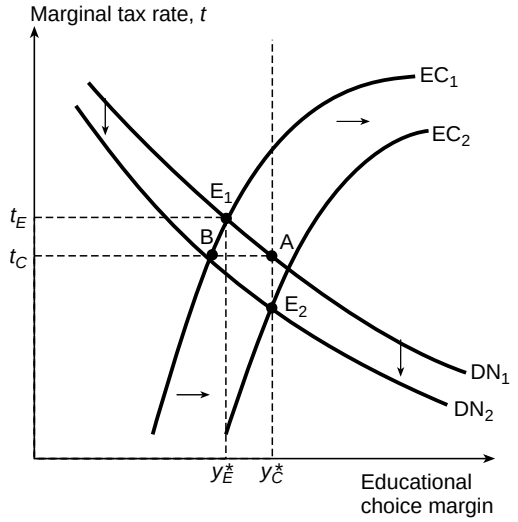
3. A Supply Constraint

It has been assumed that the supply of higher education is demand-determined, but the argument can be adapted to allow for an upper limit to the proportion of the cohort able to invest in higher education. This restriction is translated into a lower limit to the educational choice margin. Consider Figure 8 and suppose that the educational choice schedule, EC_1, and the deficit neutrality schedule, DN_1, result from the unconstrained value of the grant that is preferred by the majority of the cohort. This produces an equilibrium choice margin and tax rate of y_E^* and t_E respectively at the intersection, E_1, of the two schedules. Now suppose that an effective supply constraint is imposed so that the minimum value of y^* allowed is y_c^*. The tax rate required to finance this choice margin, at the initial unconstrained value of the grant, is t_c and the excess demand for higher education is represented by the distance AB. This distance does not measure the excess demand directly, since the number of individuals associated with any given educational choice margin depends on the shape of the distribution of ability.

The non-educated majority can at most receive external benefits from having the choice margin of y_c^*, so there is no point subsidising the educated to such an extent that there is an excess demand. A lower value of the grant shifts the educational choice schedule to the right while the deficit neutrality schedule shifts downwards. The preferred (constrained) value of the grant is that value giving the schedules EC_2 and DN_2. In this case, the intersection at E_2 gives rise to a demand for higher education that is consistent with the constrained supply. Even if the external effects of higher education are significant, a supply constraint has the effect of imposing an upper limit on the value of the grant preferred by the majority.

FIGURE 8

Quantity Rationing



4. A Progressive Income Tax

The existence of a progressive income tax means that those with very low incomes can shift relatively more of the cost of raising the grant to those with high incomes. If there is a tax-free threshold, which is typical of a progressive tax, then those below the threshold effectively have a zero marginal cost of increasing the grant if the resulting external benefit does not raise their income above the threshold. Consequently, the people with very low incomes may align themselves with those just above the educational choice margin, in being in favour of a grant increase. Similarly, those slightly below the margin may agree with the very high-income individuals in preferring to see a grant reduction. Hence the problem of establishing a majority voting equilibrium is much more complicated than in the proportional tax case. The majority of individuals, those below the choice margin, are no longer unanimous. It does not seem possible to establish the general existence of a voting equilibrium with double-peaked preferences in this case, unlike the proportional tax case. However, when more structure is added to the model, Creedy and Francois (1992b) show that by examining the detailed preference profiles of various percentiles of the distribution of ability, it is possible to find an equilibrium majority voting outcome.

It has been mentioned that the major focus concerns the choice of higher education grant and tax rate for a given tax system. However, the existence of a

tax-free threshold, combined with the fact that investment in higher education involves significant forgone earnings, implies that there may be situations in which some individuals, who otherwise have relatively high lifetime earnings, may not pay any income tax during earlier years. This in turn raises the possibility that a relatively high-income individual may prefer to see an increase in the tax-free threshold while a relatively lower-income individual, not investing in higher education, would benefit from a reduction in the threshold. Such an apparently paradoxical result would raise problems for majority voting over the income tax structure, *given* the value of the higher education grant.

The present context is just one example of a situation in which some individuals are able to shift income between periods. An important result concerning the public choice of a progressive tax system in a single-period context was established by Roberts (1977). He showed that a majority voting equilibrium exists, despite the double-peakedness of preferences, if the ranking or ordering of individuals is not affected by the tax system. But, using the present framework, Creedy and Francois (1993a) show that the result established by Roberts does not extend to the multi- period case if there is a tax-free threshold.

A further variation in the progressive tax framework was examined by Creedy and Francois (1994), who model a tax surcharge as a further means of financing grants. This takes the form of an addition to the marginal tax rate applied to those who invest in higher education, and effectively increases the progressivity of the tax system. It differs slightly from an income-contingent loan scheme since there is no requirement that the grant is fully repaid. It is found that the introduction of a tax surcharge is associated with an increase in the grant which is approved by a majority of the cohort. This is not really surprising since it lowers the marginal cost, facing those who do not invest, of raising the grant. More interesting is the result that, while the rate of return to the very high-income earners falls, those close to the educational choice margin experience an increase in the rate of return. This demonstrates the need to examine the distribution of rates of return, rather than concentrating on a single value as in the majority of empirical studies.

V. SOCIAL WELFARE

1. A Grant and Inequality

The previous section concentrated on the situation where the government is assumed to impose the grant that is preferred by a simple majority of the cohort. Given the assumed link between income-earning ability and the ability to benefit from higher education, the grant is unambiguously regressive in that it increases the inequality of net lifetime income but individuals have no concern for the

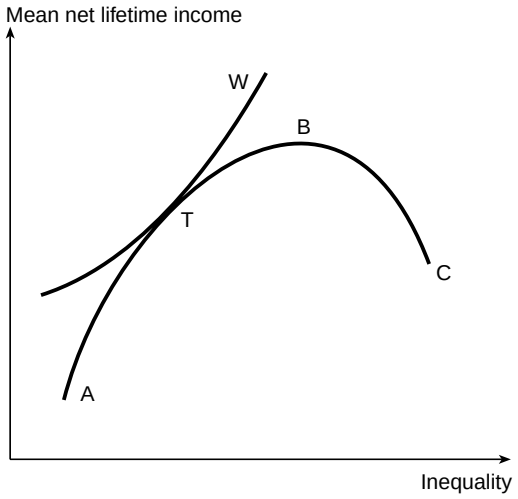
degree of inequality in the cohort. The implications for inequality are examined by Creedy and Francois (1992a), who allow for the existence of other transfer payments and introduce means-testing of the grant. The question arises of how the majority choice of grant compares with that resulting from the maximisation of a social welfare function which reflects a degree of aversion to inequality.

2. The Trade-Off between Equity and 'Efficiency'

As a result of the tax base effect and the externality, an increase in the grant will, over a certain range, be associated with an increase in the arithmetic mean net lifetime income of the cohort. A stage will nevertheless be reached when there are so many people receiving the grant that the concavity of the relationship between the externality and the proportion investing in higher education, combined with the smaller increase in the tax base as more of the lower-ability people invest, means that arithmetic mean lifetime income begins to decline. This combination of a falling mean income with an increase in inequality is unequivocably bad. Hence the range of grants producing this result can be ruled out. The general type of relationship between lifetime income and inequality is shown in Figure 9 as the line ABC.

FIGURE 9

The Trade-Off between Equity and Efficiency



It is most convenient to restrict attention to social welfare functions that can be expressed in 'abbreviated' form, that is in terms of arithmetic mean net lifetime income and a measure of inequality; for a detailed treatment of such functions, see Lambert (1993). In this case, there is no difficulty in considering a

trade-off between equity and average income, often referred to in rather loose terms as a trade-off between equity and efficiency. In terms of Figure 9, the social welfare function is described by a set of social indifference curves which are upward-sloping from left to right. If the social welfare function has no aversion to inequality, then the point B will be chosen because social indifference curves are horizontal; otherwise, the optimal position is one of tangency between an upward-sloping social indifference curve and the constraint ABC. Such a tangency position is illustrated as point T in Figure 9, on the indifference curve W.

At this level of generality, it is not clear how the choice of grant resulting from maximisation of a social welfare function compares with the majority choice, since it depends to some extent on the degree of inequality aversion of the welfare function. However, Creedy and Francois (1992b) show that the choice of grant is generally higher using a social welfare function than under majority voting, unless the aversion to inequality is very high. A high aversion to inequality implies that considerable emphasis is given to those with relatively low incomes. It might initially be thought that the maximisation of a social welfare function, even for low degrees of inequality aversion, would imply a lower grant than that chosen by majority rule. This might be suggested because the median voter has no concern for inequality, and a higher grant is associated with higher lifetime inequality. However, the median voter also has no concern for aggregate net lifetime earnings, and with a positively skewed distribution, the arithmetic mean exceeds the median value. The difference between the arithmetic mean and the median increases as the grant increases, because of the increase in relative dispersion which affects the mean but not the median. When these considerations are kept in mind, there is nothing surprising about the fact that majority voting typically results in a lower grant than the maximisation of a social welfare function.

VI. CONCLUSIONS

This paper has discussed some of the interdependencies involved in financing higher education. These interdependencies arise from the government's budget constraint, since any subsidy must be financed from tax revenue, and the requirement that there is mutual consistency between all individuals' plans and the government's decision. The discussion has used a simple and fairly general framework of analysis within which the government's decision regarding the level of a higher education grant is modelled explicitly. Comparisons were made with a public choice approach, in which the government chooses that grant preferred by a majority of the population, and a social welfare approach, in which a trade-off is made between a measure of equality and the arithmetic mean net lifetime income of individuals. When examining individuals' and the government's decisions, emphasis was placed on what happens at the various

margins. This type of emphasis is, of course, central to most economic discourse, but has been strangely neglected in much of the debate on financing higher education.

The analysis has concentrated on trying to understand the interdependencies involved in financing higher education and the implications of adopting alternative decision rules, rather than attempting to explain experience in any particular country. In considering the effects of changes, in comparative static exercises, emphasis has been placed on what happens at the various margins. In particular, given a distribution of ability levels, there is a distribution of rates of return to investment in higher education. Average rates of return, or some other single measure, can provide a misleading indication of the effects of policy changes, particularly when a tax surcharge is used. A form of surcharge has been introduced in Australia and is being debated in the UK.

The analysis has shown that the use of majority voting is likely to lead to a sub- optimal grant, in comparison with the maximisation of a social welfare function, despite the fact that a higher grant implies more inequality. Reductions in the value of a tax-financed grant are, within the framework considered, consistent with reductions in other (independent) forms of government expenditure and with reductions in the external growth effects of higher education. To the extent that the marginal external benefits of higher education decline as the proportion of individuals investing increases, it is perhaps not surprising that the industrialised countries (which have large numbers of students and are attempting to reduce government deficits) are reconsidering their methods of subsidising higher education.

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